Abstract submitted for Celebration of Women in Australian Mathematical Sciences

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Title: Computation of Geometric Galois Groups and Absolute Factorizations
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Session: Posters

An algorithm being developed to compute geometric Galois groups of polynomials over $\mathbb{Q}(t)$ is discussed. This algorithm also computes a field extension such that the factorization of a polynomial over this field extension is the absolute factorization of the polynomial.

Building on the algorithm to compute Galois groups of polynomials over $\mathbb{Q}$ by Fieker and Klüners, the algorithm to compute Galois groups of polynomials over $\mathbb{Q}(t)$ described in Krumm and Sutherland and the algorithm to compute Galois groups of reducible polynomials described in my previous publications, I present an algorithm to compute the geometric Galois group of a polynomial over $\mathbb{Q}(t)$.

I compute over the algebraic closure K of $\mathbb{Q}$ in the splitting field Γ of f. Since $\mathrm{Gal}(f/K(t)) = \mathrm{Gal}(f/\mathbb{C}(t))$, I compute the geometric Galois group of f as the Galois group of f considered as a polynomial over $K(t)$. The task is to determine which subgroup of $\mathrm{Gal}(f)$ fixes $K(t)$.

I am aware of some results computed by hand by Jürgen Klüners. However, in all of the cases I have access to these geometric Galois groups are the same as the Galois group over $\mathbb{Q}(t)$.

I have begun to implement the algorithm I describe using the computational algerba system Magma, and will illustrate my progress with an example in which the geometric Galois group is a non-trivial proper subgroup of the Galois group.

I will also mention how geometric Galois groups are linked to inverse Galois theory.

Once I compute the algebraic closure K in the computation of the geometric Galois group I can factor polynomials over this field using existing functionality of Magma. Thus I can compute the absolute factorization of $f \in \mathbb{Q}(t)[x]$ without using calculations over $\mathbb{C}$. This approach is different to those described in Chèze and Galligo and other publications.